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COMPLETE SPECIFICATION.

Improvements in Method and Apparatus for Extracting the Liquid or Soluble Constituents from Disintegrated Vegetable Materials.

I, JOHN ENNIS SEARLES Jr., of 810 St. Marks Avenue, Brooklyn, in the county of Kings, and State of New York, United States of America, do hereby declare the nature of my invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement :—

This invention relates first, to a method of extracting from disintegrated vegetable materials their liquid or soluble constituents; and, secondly, to certain forms of apparatus by which said method can be carried into effect. The new method by which the desired result is accomplished consists in confining the disintegrated material which is to be operated upon in a suitable chamber, herein called the compression chamber, and therein subjecting it to compression between a compressing plunger on one side and a body of liquid, herein called a liquid anvil, upon the other side of the material operated upon, the liquid products of such compression being discharged either through perforations in the said plunger or in the portions of said cylinder adjoining the place where the plunger concludes its compressing stroke. The said body of liquid being either itself closely confined in a reservoir connected with said chamber, or held therein under a prescribed degree of pressure, serves as an abutment or anvil which partially supports the mass of disintegrated material against which the thrust of the plunger is delivered.

The disintegrated material operated upon, which for the sake of brevity it is convenient to call the "fibre," forms a plug which closely fits the bore of the cylinder, or compression chamber in which the plunger reciprocates. The said "plug" is composed of bodies of fibre which are successively fed into the path of the plunger, and which by the working strokes thereof are compressed one upon another in the form of wads.

At each working stroke of the plunger a wad of fibre is added to the adjacent end of the plug, and the plug being thereby increased in length is driven bodily forward into the liquid anvil which partially supports it. Therefore, at each stroke of the plunger a certain portion of the liquid composing the anvil is displaced, and by reason of the pressure which the said liquid is under is compelled to exude through the compressed material composing the plug The exuding liquid drives before it any liquid which it finds present in the plug, and by being brought into enforced contact with the soluble constituents of the material operated upon, dissolves and carries those soluble constituents with it through the plug and through passages formed either in the plunger or in the part of the cylinder adjoining the plunger, to suitable channels leading to a receiving tank. The formation of the plug by successive strokes of the plunger is assisted by the frictional hold of the fibre upon the wall of the compression chamber.

The degree of density acquired by the plug depends partly upon the said frictional hold and partly upon the pressure at which the liquid composing the anvil is maintained.

The liquid against which the plug is compressed thus performs two functions, that of an anvil against which the fibre is driven by the working strokes of the compressing plunger, and also that of a solvent or washing fluid which by being compelled to exude through the plug as an avenue of escape from the pressure which it is under dissolves or drives before it soluble or liquid matter which it finds therein contained. The characteristic features of apparatus for carrying out this process embrace a compression chamber in which the plug is formed by the compression of successive bodies of fibre; a reciprocating plunger preferably provided with perforations to serve as the outlets for the liquid products of compression; a chamber for containing the liquid

composing the liquid anvil, which chamber is a laterally enlarged continuation of the compression chamber, at the end opposite that in which the compressing plunger reciprocates and which irrespective of its form constitutes the anvil chamber ; the said anvil chamber, in addition to serving as a container for the liquid anvil, is also the receiver of the refuse composed of the fibre which during its passage through the compression chamber has had its natural juice and its soluble constituents extracted. The anvil chamber, if below the level of the compression chamber, is provided with a tight-fitting removable door, for permitting access to its interior when occasion arises to remove the refuse material.

The liquid in the anvil chamber can be held therein under any desired degree of pressure, either by being connected with a service pipe delivering the liquid under the desired degree of pressure, or by being provided with an adjustable yielding valve which may be adjusted to yield whenever the pressure of the liquid rises to a prescribed point in consequence of the projection of the plug into it by the successive strokes of the plunger ; or the anvil chamber may be arranged to extend upward from the compression chamber to a sufficient height to enable it to contain a column of water affording hydrostatic pressure upon the plug to the extent required to sustain the plug against the working strokes of the compressing plunger. This invention is peculiarly effective for extracting saccharine matter from disintegrated sugar-yielding plants, such as cane, sorghum or beet roots. For this purpose water is employed as the liquid anvil, but in making spirituous extracts the liquid employed may be alcohol, naphtha or any other desired fluid, without departing from the invention. The accompanying drawings, illustrating various forms of apparatus for carrying out the prescribed process, are as follows :

Figs. 1, 2 and 3, are respectively, a top view, a central vertical section, and an end elevation, showing a form of apparatus in which there is employed a horizontal compression chamber connecting at one end with a downwardly inclined anvil chamber provided with a tight fitting removable door. Fig. 4 is a central vertical section of a form of apparatus employing a vertical compression chamber arranged at the top of a bottle-shaped anvil chamber. Fig. 5 is a central vertical section of a form of apparatus employing a vertical compression chamber arranged at the bottom of an anvil chamber which is open at the top, and which is provided with an interiorly contained elevator, for assisting in the upward movement of the screened fibre to the chute by which it is discharged from the top of the anvil chamber. Fig. 6 is a central vertical section of a form of apparatus employing a horizontal compression chamber connected with the curved lower end of an upright anvil chamber open at its upper end, and provided with a discharging elevator similar to that shown in Fig. 5.

Fig. 7 illustrates a modification of the apparatus, in which an impervious plunger is employed, and the outlets for discharge of the liquid products of compression consist of perforations in the part of the compression chamber immediately adjacent to the place where the plunger concludes its working stroke.

Referring to the drawings, it will be seen that Figs. 1, 2 and 3 represent a compressing apparatus composed of the horizontal cylinder A, to which is connected the laterally enlarged chamber B, provided at its large end with a removable water-tight door C, and having connected with it a pipe D, for the introduction into the chamber B of the liquid which is to serve as the liquid anvil. The pipe D may be provided with a valve E, and it may be extended vertically upward to such a height as may enable it to serve as a stand pipe, or it may be connected with a service pipe supplying liquid under prescribed pressure. In the end of the cylinder A, opposite that connected with the chamber B, is the plunger F, to which is imparted a definite range of reciprocating motion by means of a pitman, G, from the crank, H, of the rotating balance wheel I. It is preferred to employ perforations in the plunger as the outlets for the liquid products of compression, and the longitudinal perforations *f* are symbolic representations of the meshes in the sieves with which the face of the plunger is provided and by which it is enabled to perform the function of a screen as well as that of a compressing device.

The liquid products of compression escape through the perforations f into the transverse channel f^1, and the longitudinal channel f^2, formed in the plunger and along the bottom of the extended lower half of the cylinder A, which constitutes the trough J, from the end of which the liquid products of compression fall into a tank suitably placed to receive them. Outlets for the liquid products of compression may also be provided by forming the holes f^3, as shown in Fig. 2, in the part of the cylinder adjacent to the place where the plunger ends its working stroke. Such holes, however, are not necessary if the pervious plunger is employed. If an impervious plunger is employed, as illustrated in Fig. 7, it will be necessary to provide the similar holes f^4 for the outlet of the liquid products of compression through the wall of the compression chamber. A feed opening K is formed in the upper side of the cylinder A, through which the masses of fibre to be compressed are successively fed into the cylinder in front of the perforated head of the plunger. To assist in the formation of the plug by holding back the fibre, the end of the cylinder adjoining the chamber B may be tapering. This may be conveniently effected by inserting in that end of the cylinder the tapering nozzle L.

In the form of apparatus represented in Fig. 4, the cylinder A^1 is erected upon the top of the anvil chamber B^1, which is provided at the bottom with a removable water-tight door C^1. At its upper end the cylinder A^1 is provided with a flaring mouth K^1, which constitutes the hopper for feeding in the fibre which is to be compressed. In this case the vertically reciprocating plunger F^1 is wholly withdrawn from the cylinder A^1 at every upward stroke, and during its downward or working stroke the perforated head f^1 of the plunger drives into the upper end of the cylinder the charge of fibre which may have been fed into the hopper K^1. The convergent walls of the hopper K^1 are perforated, as shown, and the perforated portion of the hopper is provided with a jacket J^1, to which is attached a discharge pipe j. The liquid products of compression compelled to exude through the mass of compressed fibre and through the perforations of the plunger at each downward or working stroke thereof, flow into the jacket J^1, from which they are conducted by the pipe j to the receiving tank, j^1.

In the modification illustrated in Fig. 5, hydrostatic pressure is employed to enable the liquid anvil to oppose the necessary resistance to the upward movement of the plug of fibre which in this case is subjected to compression by the upward stroke of the plunger.

It will be seen that the plunger F^2 reciprocates in the lower end of the cylinder A^2, alternately opening and closing the lateral feed opening, K^2. The upper end of the cylinder A^2 is made convergent, and may be provided with an adjustable valve, a, which by means of a set screw, a^1, can be held in position to more or less obstruct the upward movement of the fibre during the initial formation of the plug, after the formation of which the valve can be opened to permit the free upward movement of the refuse material into the chamber B^2, provided preferably with an elevator, b, for loosening and assisting in the elevation of the refuse material to the top of the chamber B^2, where it is discharged into the chute C^2.

In starting this apparatus the chamber B^2 is not filled with liquid until the plunger has made a sufficient number of strokes to collect and form a plug of such density that its frictional hold upon the wall of the cylinder will enable it to sustain the weight of the column of liquid above it. In the modification shewn in Fig. 6 hydrostatic pressure is also employed, the compression being caused by a reciprocating plunger.

Having now particularly described and ascertained the nature of my said invention, and in what manner the same is to be performed, I declare that what I claim is :—

1st. The herein described method of extracting from disintegrated vegetable materials their liquid and soluble constituents ; which consists in progessively compacting the material operated upon into a plug closely fitting the bore of a suitable chamber and therein progressively subjecting said material to compression between a

compressing plunger and a liquid anvil in proximity to suitable outlets for the discharge of the liquid products of such compression.

2nd. In an apparatus for extracting from disintegrated vegetable materials their liquid or soluble constituents, the combination, as herein set forth, of a reservoir for containing a liquid which is to serve as a liquid anvil, a compression chamber forming a continuation of said reservoir, and receiving the liquid therefrom at suitable pressure, a compressing plunger and means for reciprocating said plunger in a portion of said compression chamber, a feed opening for feeding masses of disintegrated vegetable materials successively into the path of said plunger and suitable outlets for the discharge of the liquid products of compression from said compression chamber.

Dated this 26th day of November 1889.

ABEL & IMRAY,
Agents for the Applicant.

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Fig. 1.

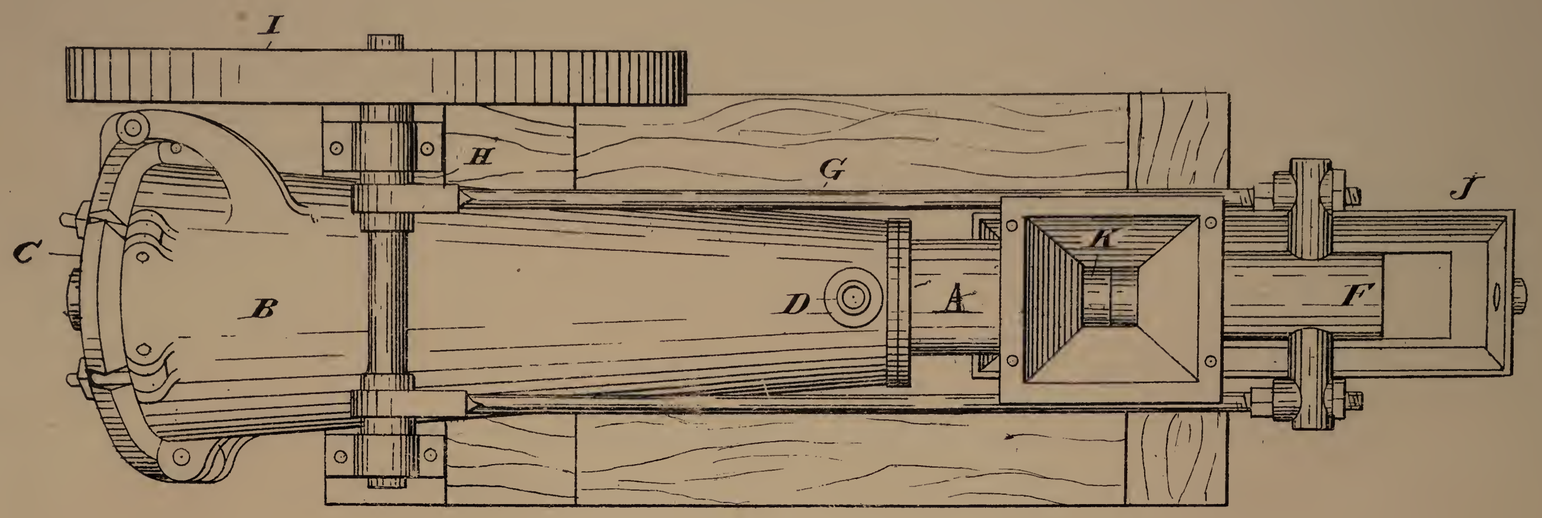

Fig. 2.

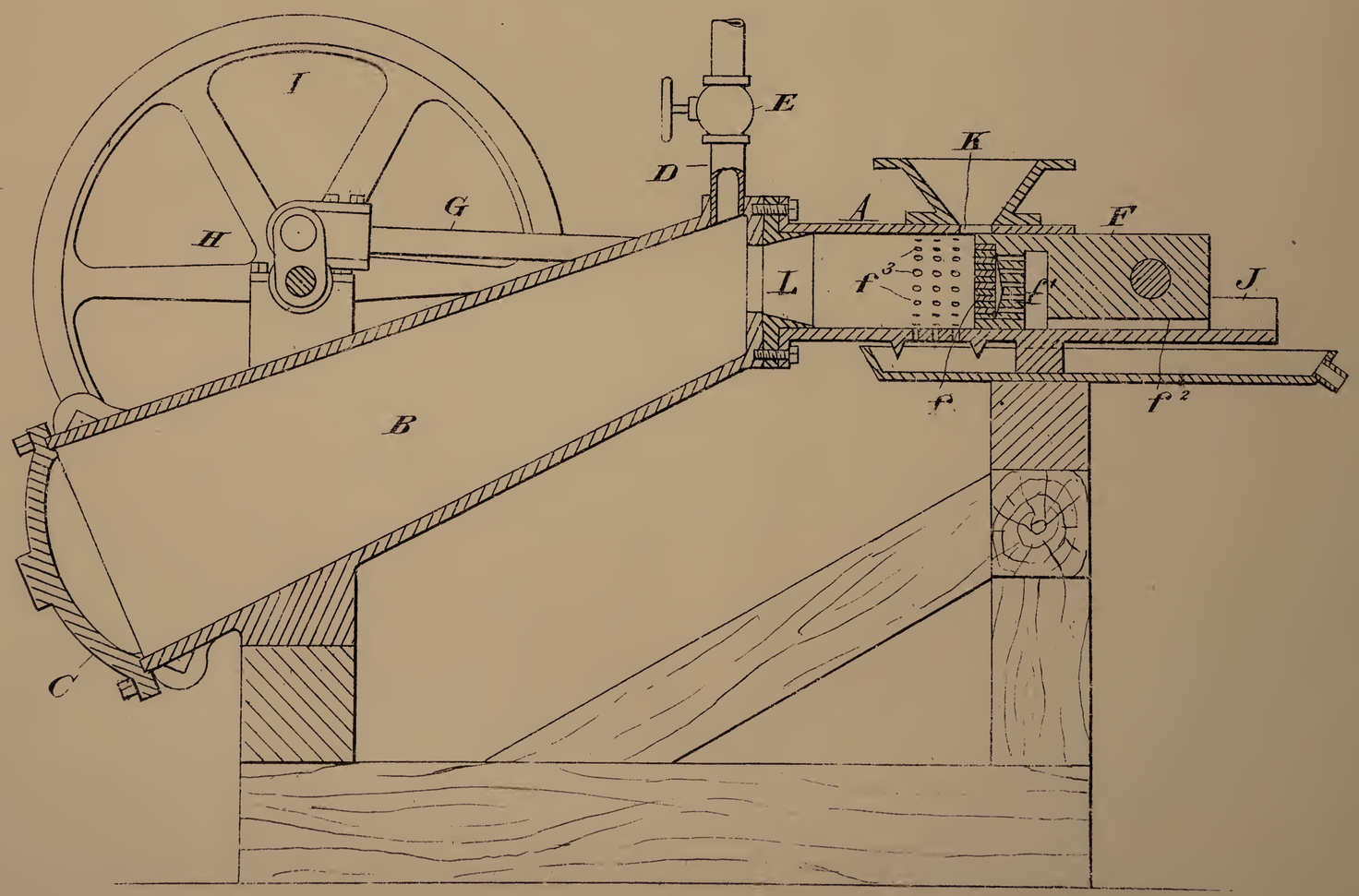

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Fig. 3.

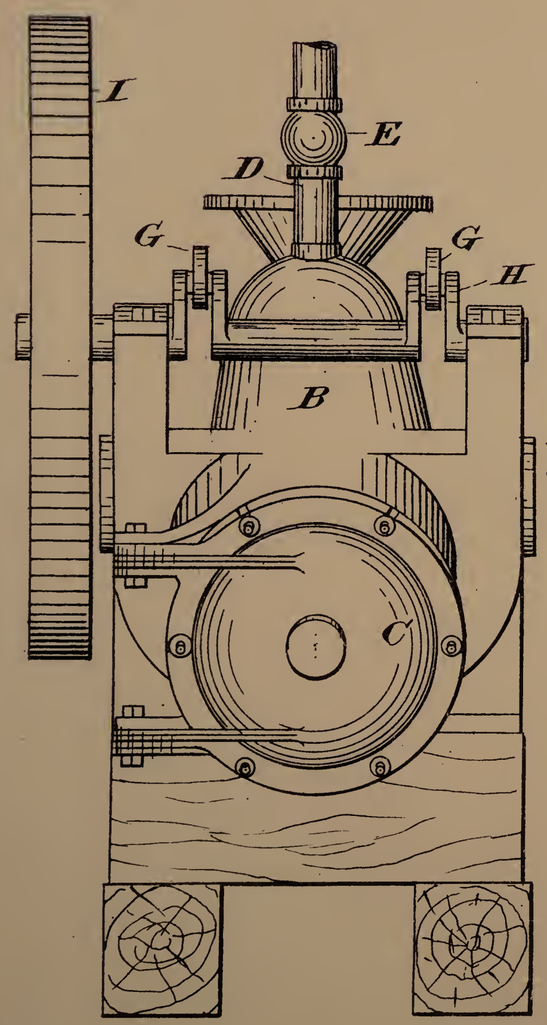
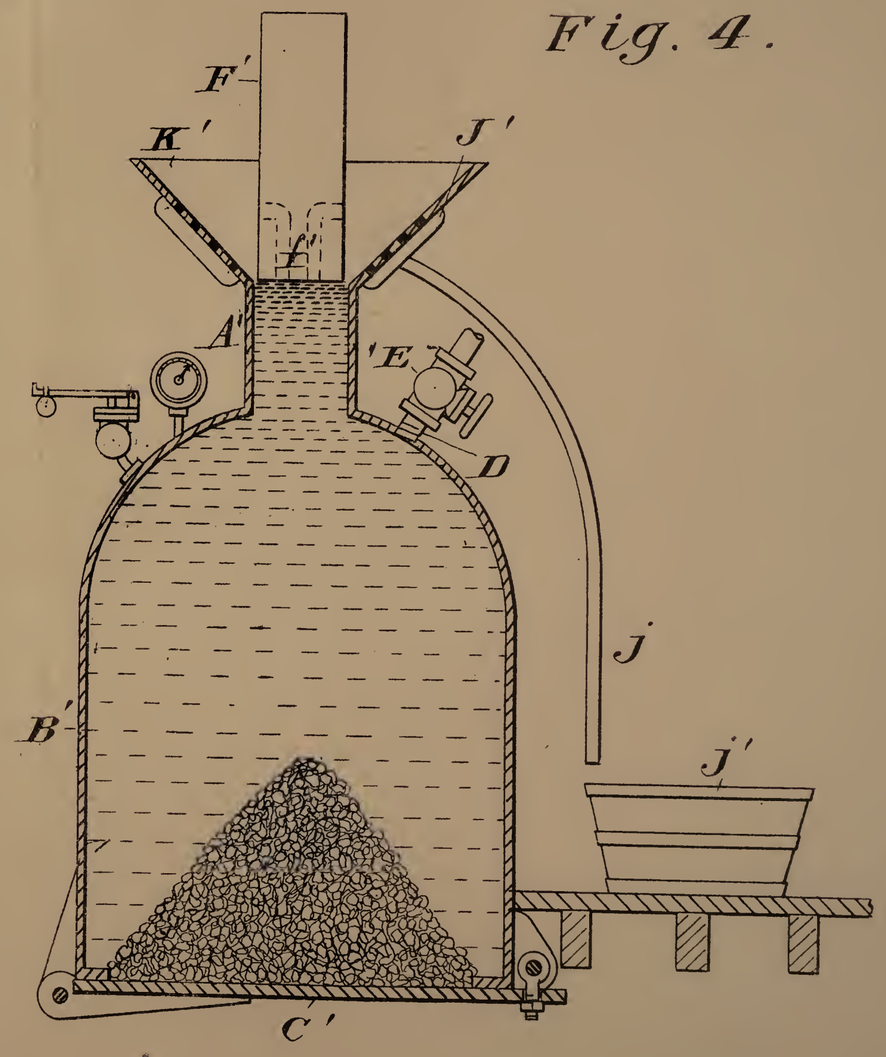


Fig. 4.



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SHEET 5.

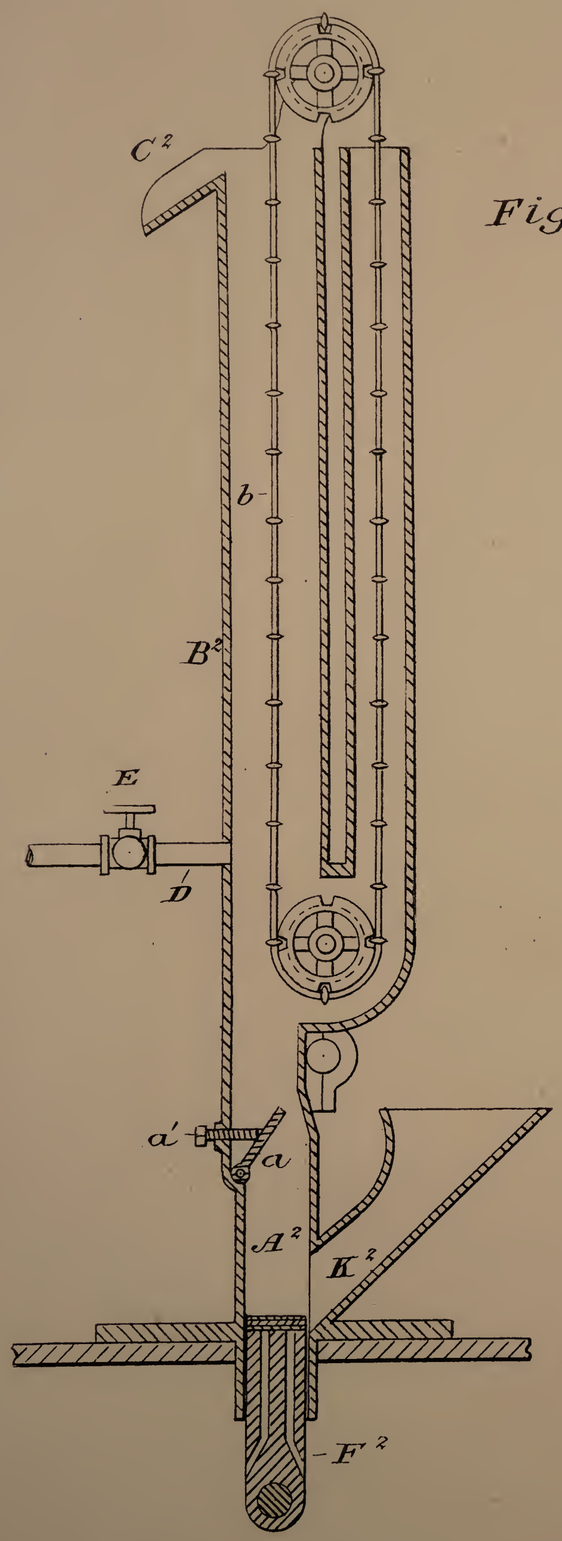

Fig. 5.

Fig. 6.

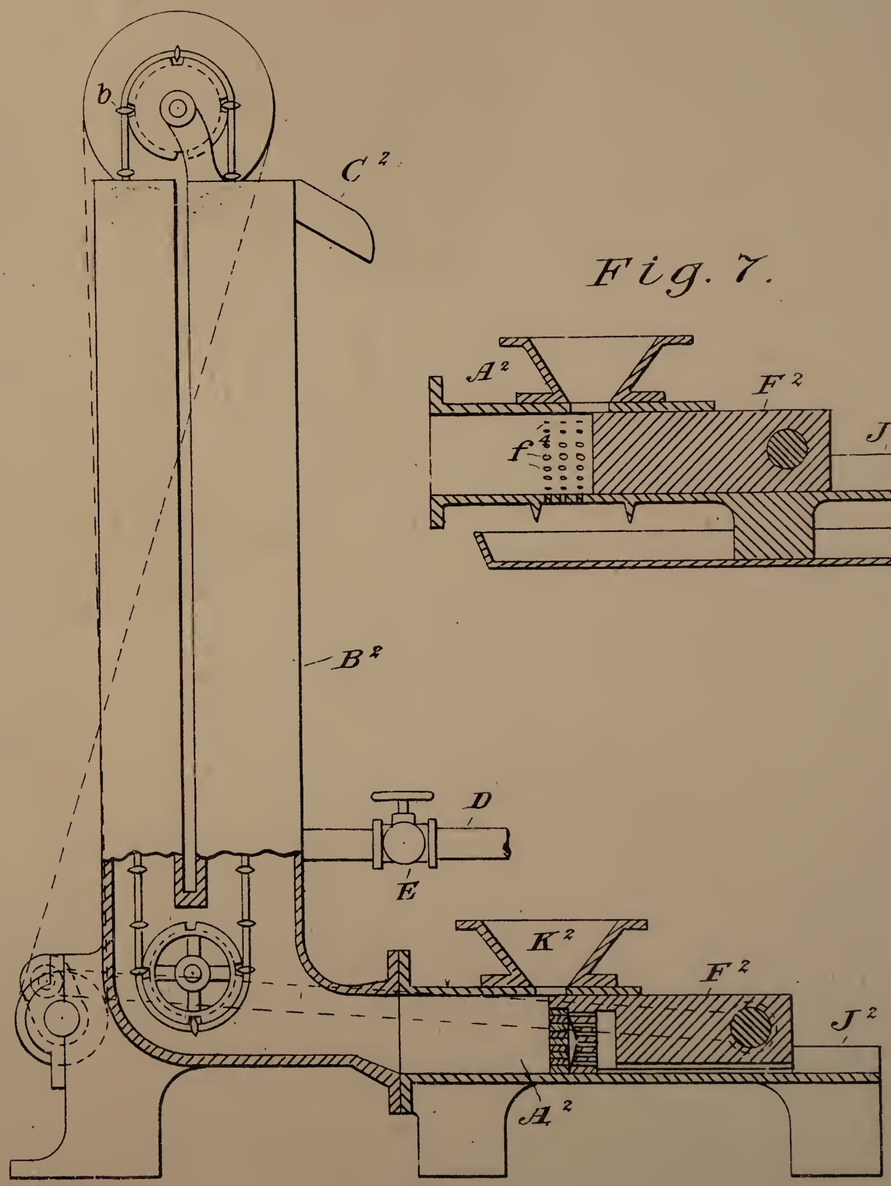

Fig. 7.

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